

An aerial photograph of an industrial and urban area. A river flows through the center, with several large circular tanks and industrial buildings along its banks. To the right, there are multiple railroad tracks and a large parking lot filled with cars. The foreground shows a mix of industrial structures, parking lots, and some green spaces.

Tidal Four Mile Run Total Maximum Daily Load Study

**Technical Advisory Committee Meeting
October 30, 2008**

Meeting Agenda

- **Water Quality Assessments and TMDL Process**
Katie Conaway, VA Department of Environmental Quality
- **Review of Non-Tidal TMDL, Bacteria Source Assessment, and TMDL Development**
Ross Mandel, Interstate Commission on the Potomac River Basin
- **Next Steps**
- **Questions**

TMDL Background Information

Why are we here?

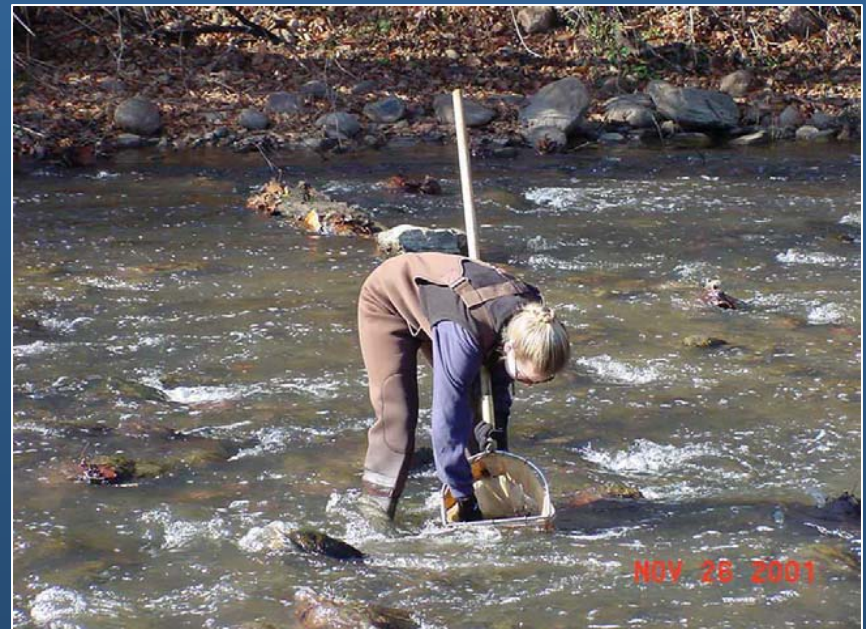
The tidal portion of Four Mile Run does not meet water quality standards.

- How do we know the standards aren't being met?
- Why doesn't Tidal Four Mile Run meet standards?
- What is being done to correct the problem?



How do we know if water bodies in Virginia are healthy?

- Perform physical and chemical monitoring on water bodies throughout the state.
- Monitor parameters such as:
 - pH
 - Temperature
 - Dissolved Oxygen
 - Biological Community
 - Bacteria
 - Nutrients
 - Fish Tissues
 - Metals/Toxic Pollutants



What does DEQ do with the monitoring data that is collected?

Compare the data collected to the water quality standards.

Water Quality Standards:

- Regulations based on federal and state law.
- Set numeric and narrative limits on pollutants.
- Consist of designated use(s) and water quality criteria to protect the designated uses.



Designated Uses

- Recreational
- Public Water Supply
- Wildlife
- Fish Consumption
- Shellfish
- Aquatic Life



- The attainment of the recreational use is evaluated by testing for the presence of *E. coli* bacteria.

Recreational Use Impairment

What are Fecal Coliform and *E. coli* Bacteria?

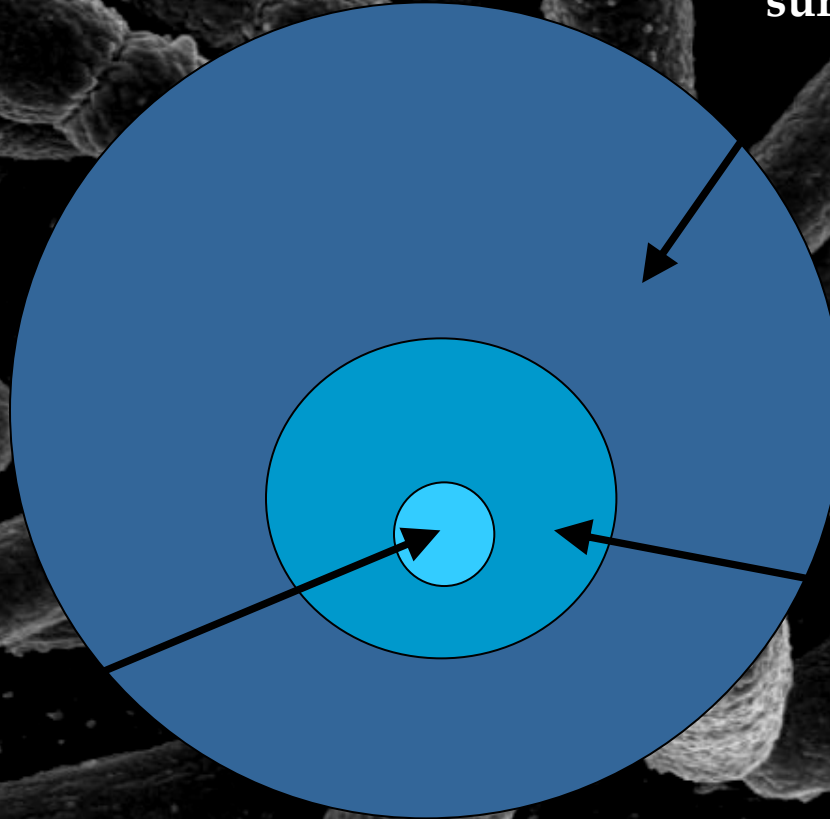
Coliform Bacteria:
Commonly found in soil, decaying vegetation, animal feces, and raw surface water

***Escherichia coli*:**

- Subset of fecal coliform bacteria
- Correlate better with swimming associated illness

Fecal Coliform:

- Found in the digestive tract of humans and warm blooded animals
- Indicator of the potential presence of pathogens in water bodies



Potential Sources of Fecal Coliform Bacteria



What is the Water Quality Standard for Bacteria?

Indicator	Instantaneous (cfu/100mL)	Geometric Mean (cfu/100mL)
E. coli	235	126

- In order for a water body to be listed as impaired:
 - There must be at least two samples that exceed the water quality criterion.
 - Greater than 10.5% of the total samples must be exceedances.
- Geometric Mean criterion applies when there are two or more samples collected within a calendar month.

What happens when a water body doesn't meet water quality standards?

- Waterbody is listed as “impaired” and placed on the 303(d) list.
- Once a water body is listed as impaired, a Total Maximum Daily Load value must be developed for that impaired stream segment to address the designated use impairment.
- TMDL Studies are required by law:
 - 1972 Clean Water Act (CWA)
 - 1997 Water Quality Monitoring Information and Restoration Act (WQMIRA)

What is a TMDL ?

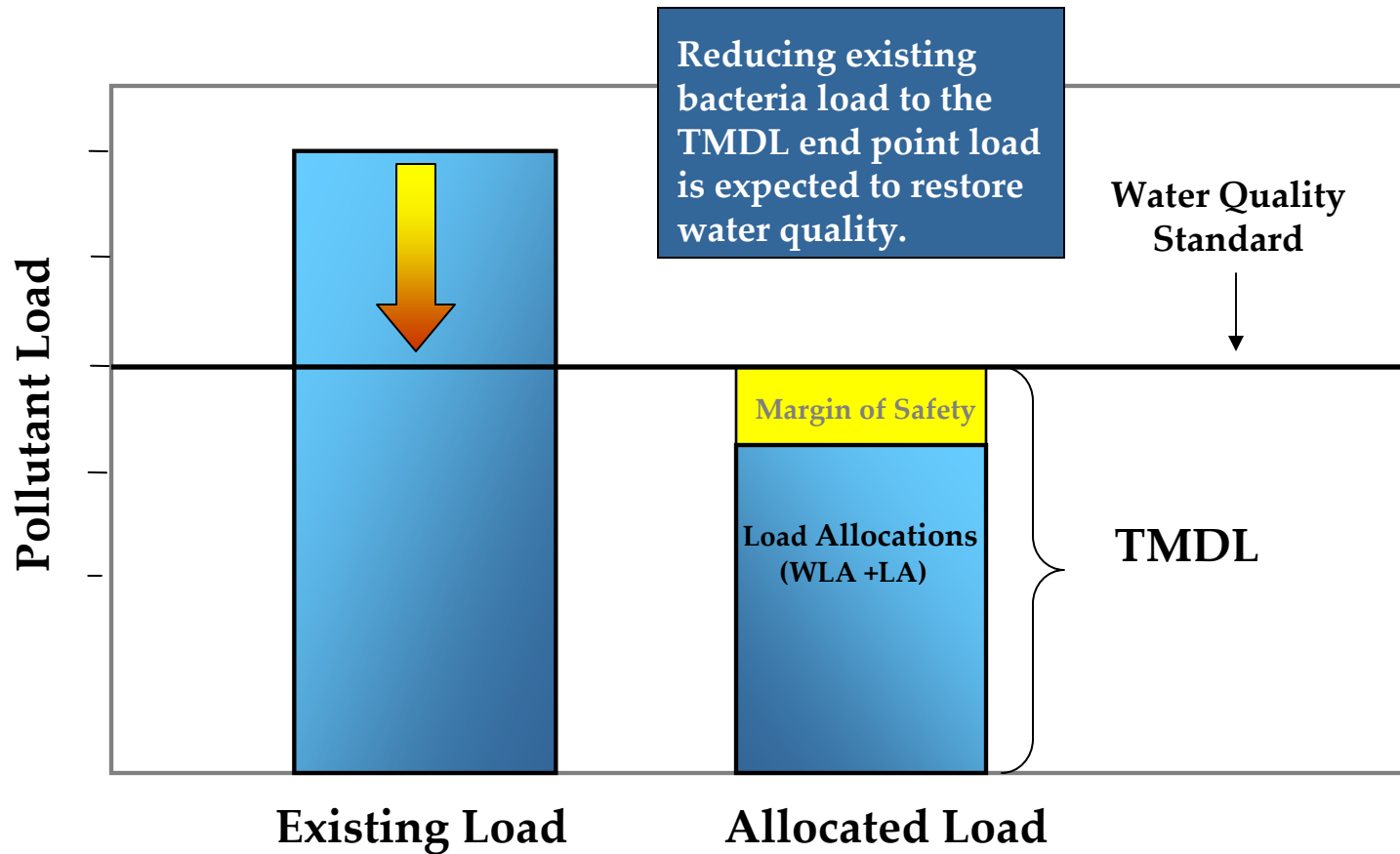
Total Maximum Daily Load

$$\text{TMDL} = \text{Sum of WLA} + \text{Sum of LA} + \text{MOS}$$

Where:

TMDL	=	Total Maximum Daily Load
WLA	=	Waste Load Allocation (point sources)
LA	=	Load Allocation (nonpoint sources)
MOS	=	Margin of Safety

An Example TMDL



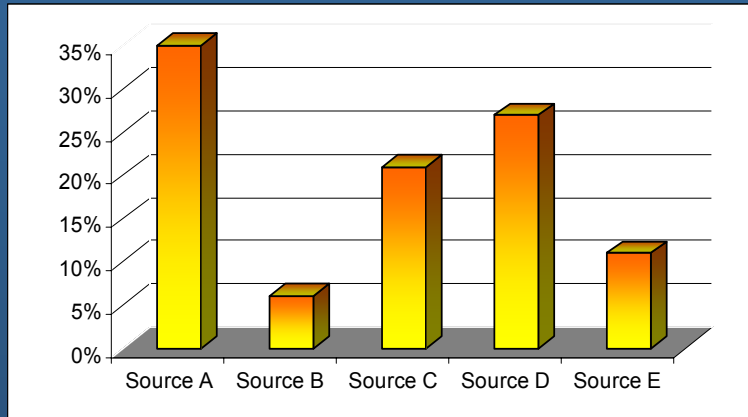
Required Elements of a TMDL

A TMDL must:

- Be developed to meet Water Quality Standards
- Be developed for critical stream conditions
- Consider seasonal variations
- Consider impacts of background contributions
- Include wasteload and load allocations (WLA, LA)
- Include a margin of safety (MOS)
- Be subject to public participation
- Provide reasonable assurance of implementation

TMDL Development Methodology

1. Identify all sources of a given pollutant within the watershed.



2. Calculate the amount of pollutant entering the stream from each source type.

3. Enter available data into a computer model. Model simulates pollutant loadings into the watershed.

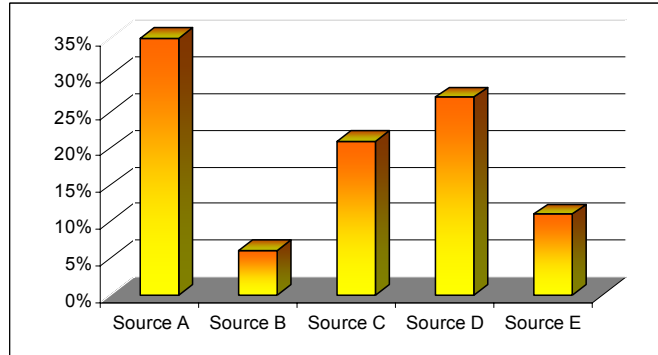
4. Use the model to calculate the pollutant reductions needed, by source, to attain Water Quality Standards.

5. Allocate the allowable loading to each source and include a margin of safety.

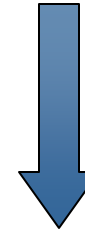


We are here

TMDL Study

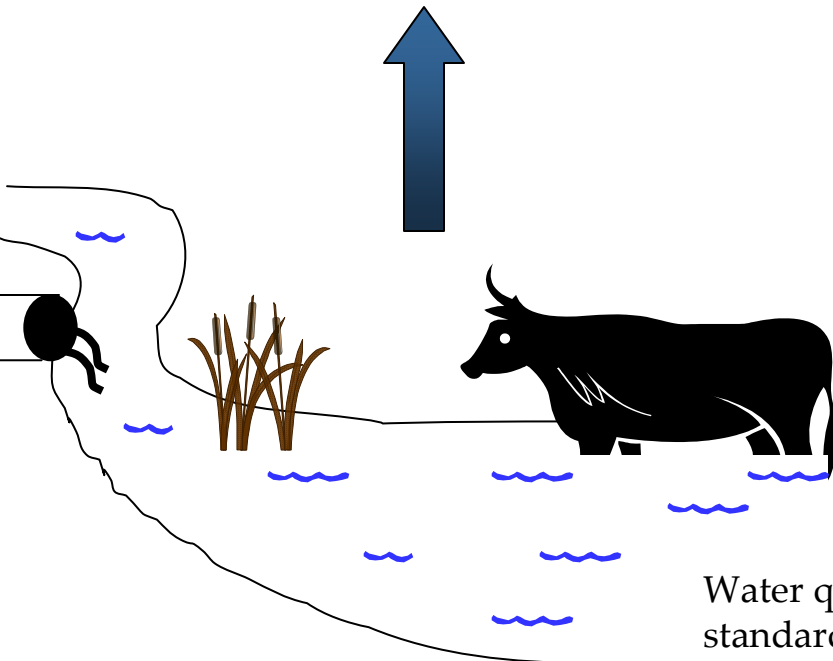


Implementation Plan

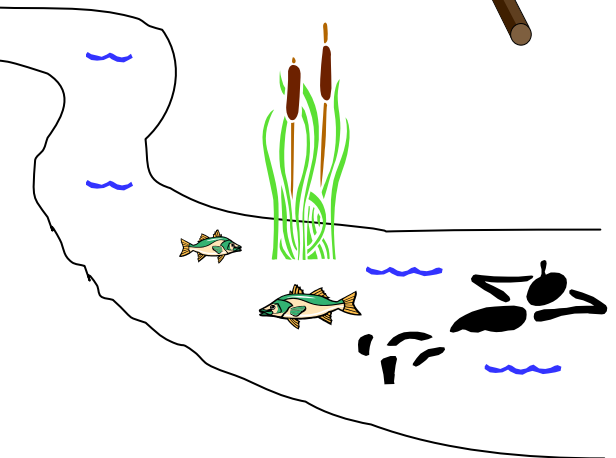


Implementation

Monitoring



Water quality standards not met



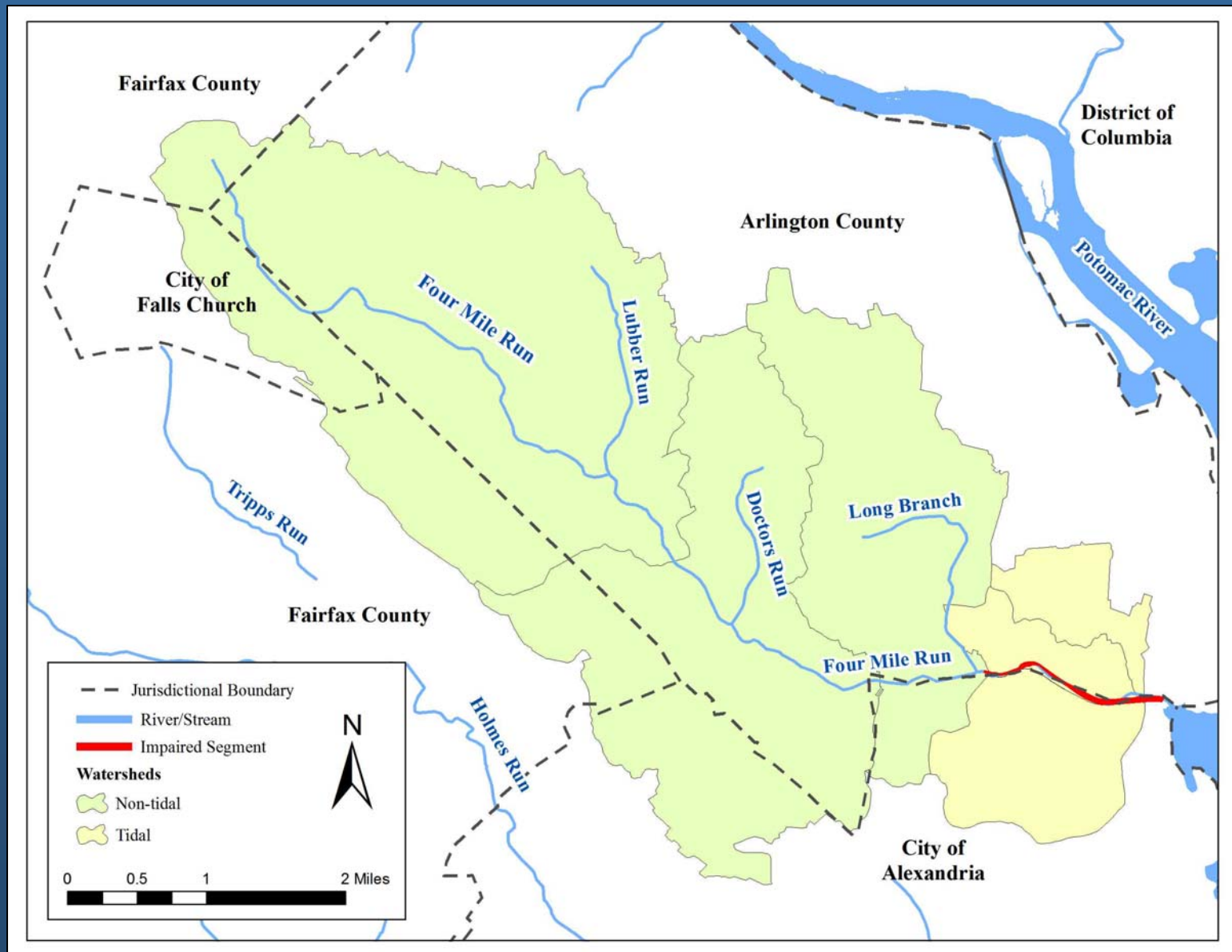
Questions?

Total Maximum Daily Load Development for Tidal Four Mile Run

Topics

- Review of Non-tidal Four Mile Run TMDL
- Watershed Description
- Review of Existing Monitoring Data
- Technical Approach to TMDL Development
- TMDL Scenario Assumptions
- Tasks

Location of Tidal Four Mile Run



Four Mile Run Non-Tidal Bacteria TMDL

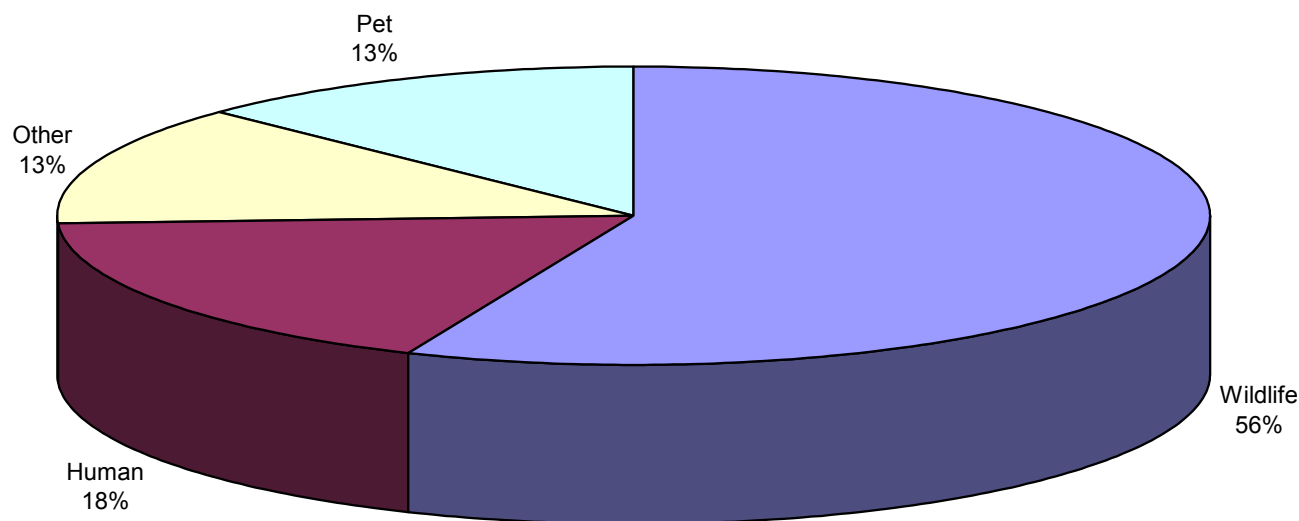
(Northern VA Regional Commission)

- One of the first bacteria TMDLs in primarily urban watershed.
- One of the first TMDLs to base bacteria loads on Bacteria Source Tracking.
- Used Hydrological Simulation Program Fortran (HSPF) to simulate fate and transport of bacteria from 14 land uses.

BST and Bacteria Loading Rates

- BST used “genetic fingerprinting methodology.
- 55 samples collected at 31 sites (including 3 in tidal drainage).
- Bacteria loading rates (#/ac/day) developed for fourteen land uses, based on BST, expert opinion of urban naturalists, and literature.

BST Results for Four Mile Run Watershed*



** Taken from the Bacteria TMDL for Non-Tidal Four Mile Run*

HSPF Model

- Simulates hydrology, hydraulics, and fate and transport of fecal coliform bacteria.
- 14 land uses represented in 3 non-tidal subwatersheds.
- Flow calibrated against daily observed flows at USGS gage at Shirlington Road; bacteria calibrated against observations primarily from VADEQ station at Columbia Pike.
- Simulation period: Jan 1999 – May 2001.

Non-Tidal TMDL Results

- A 95% reduction in bacteria loads from wildlife, and a 98% reduction in loads from pets and human sources, will meet the (former) 30-day geometric mean FC standard of 200 #/100 ml with a 5% margin of safety.
- Implementation Plan (NVRC, 2004) targets anthropogenic sources of bacteria—no direct controls on wildlife.

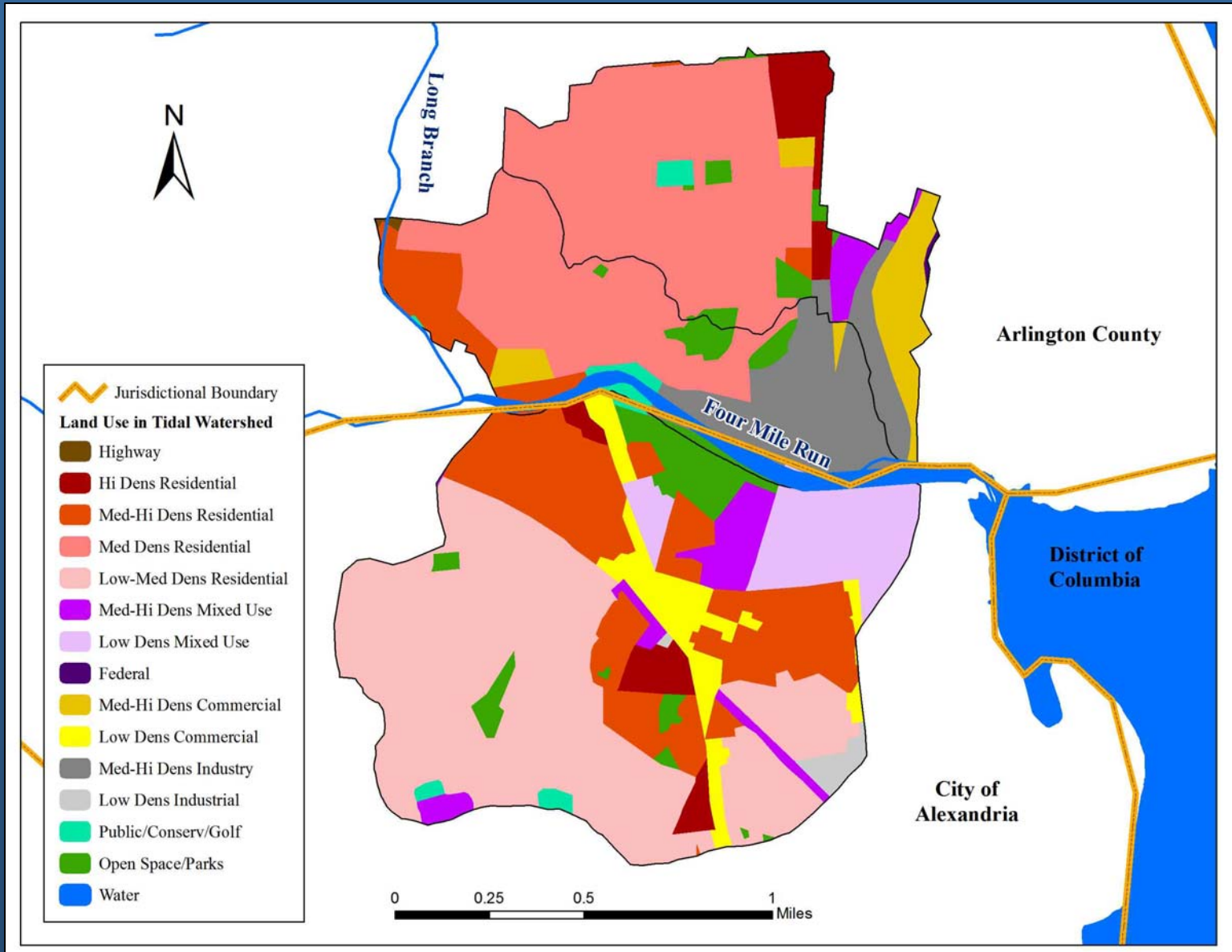
TMDL Study for Tidal Four Mile Run

- TMDL Study Area: Arlington County, City of Alexandria
- Impairment: Recreational Use – exceeds the water quality standard for *E. Coli* bacteria

Station	2006 Assessment Exceedance Rate for <i>E. coli</i> Bacteria	2008 Assessment Exceedance Rate for <i>E. coli</i> Bacteria
1AFOU000.19 GW Parkway	40% 2 of 5 Samples	18% 3 of 17 samples

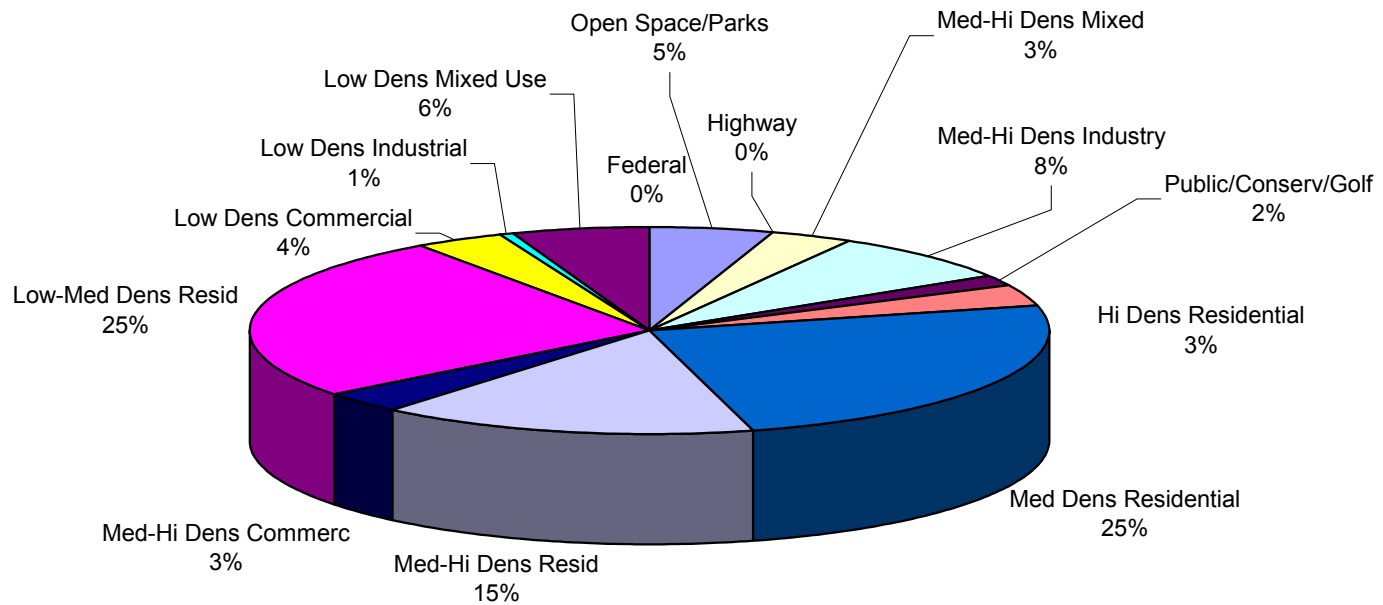
*2006 Assessment used data from 2000 – 2004.
2008 Assessment used data from 2001 – 2006.*

Land Use Tidal Four Mile Run Drainage



Taken from the Non-Tidal Bacteria TMDL for Four Mile Run, as prepared by the Northern Virginia Regional Commission.

Land Use Distribution



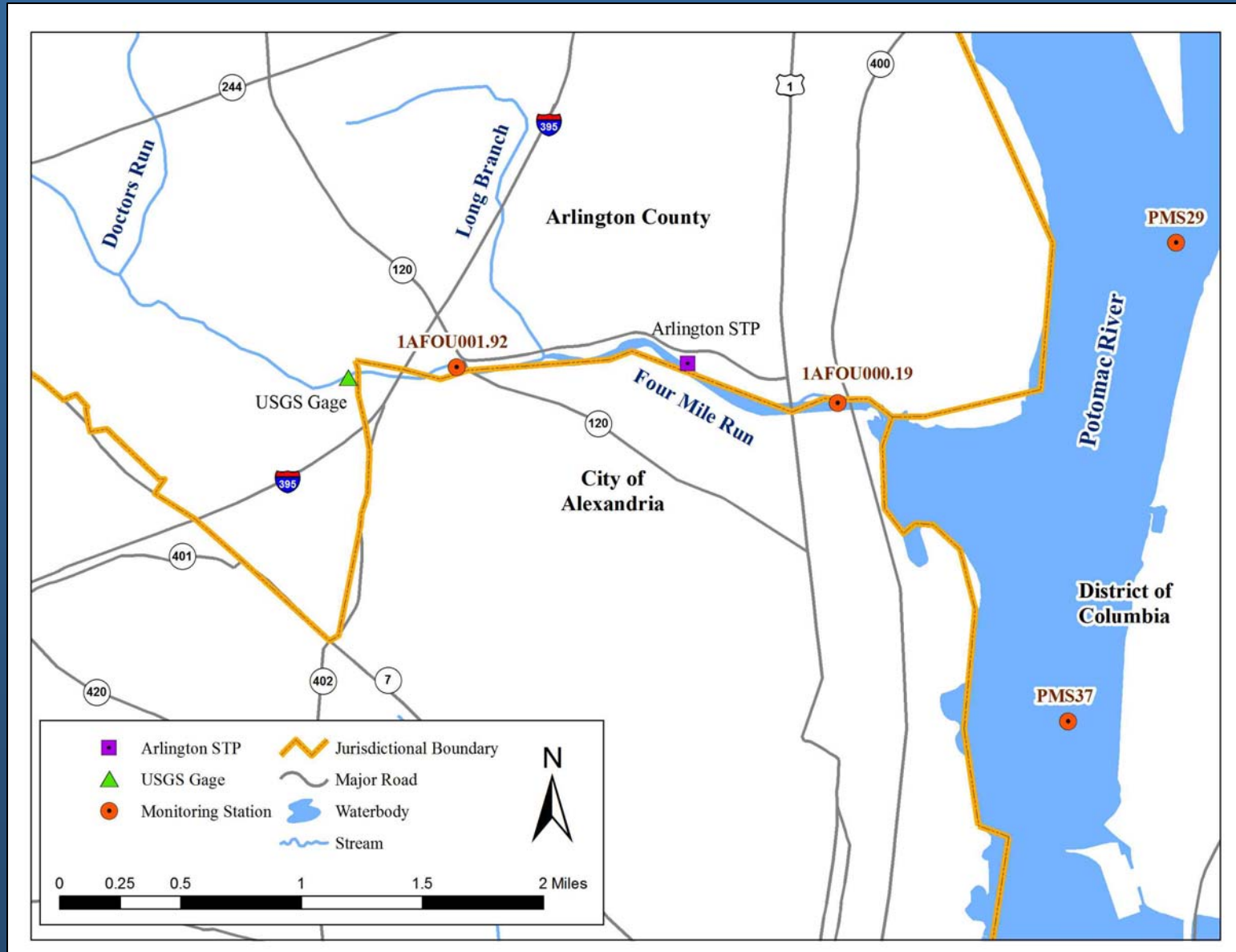
Sources of Bacteria in Tidal Four Mile Run

- Upstream Non-Tidal Four Mile Run
- Arlington WWTP
- DC Boundary
- Drainage to Tidal Four Mile Run
 - Wildlife
 - Human
 - Pets
 - Other

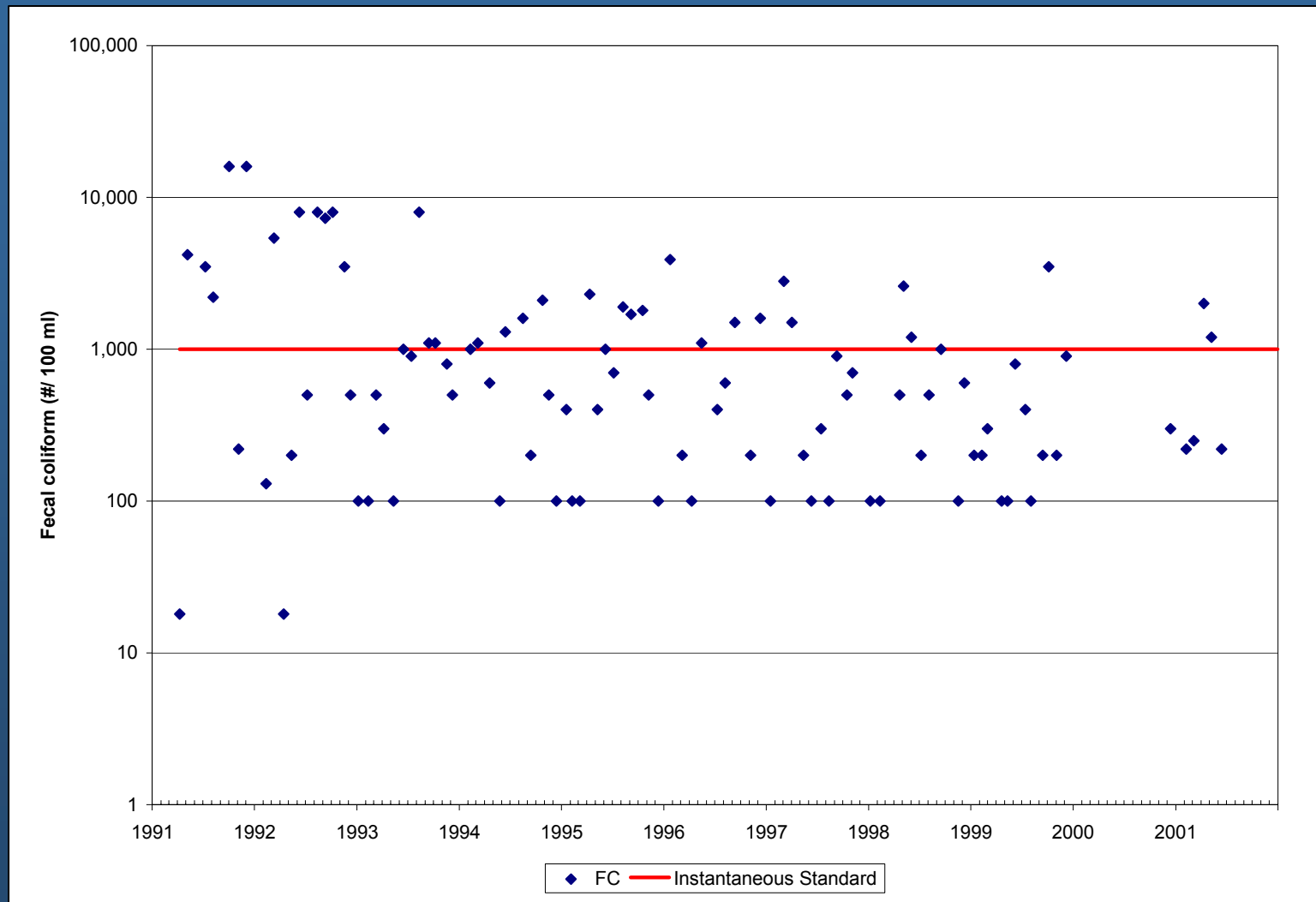
Municipal Separate Storm Sewer System (MS4) Permits

- Arlington County
- City of Alexandria
- VDOT
- George Washington Memorial Parkway

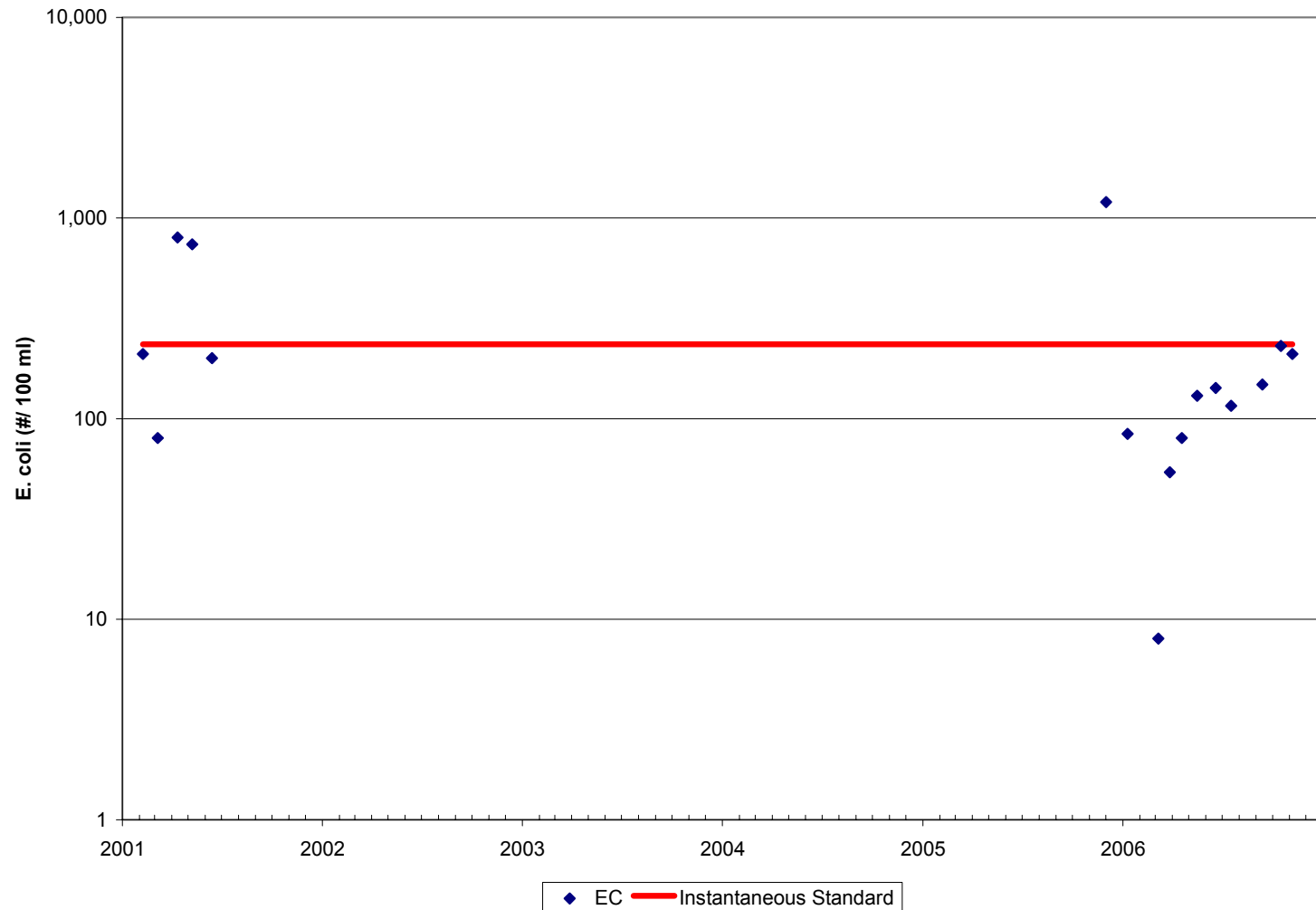
Monitoring Station Locations



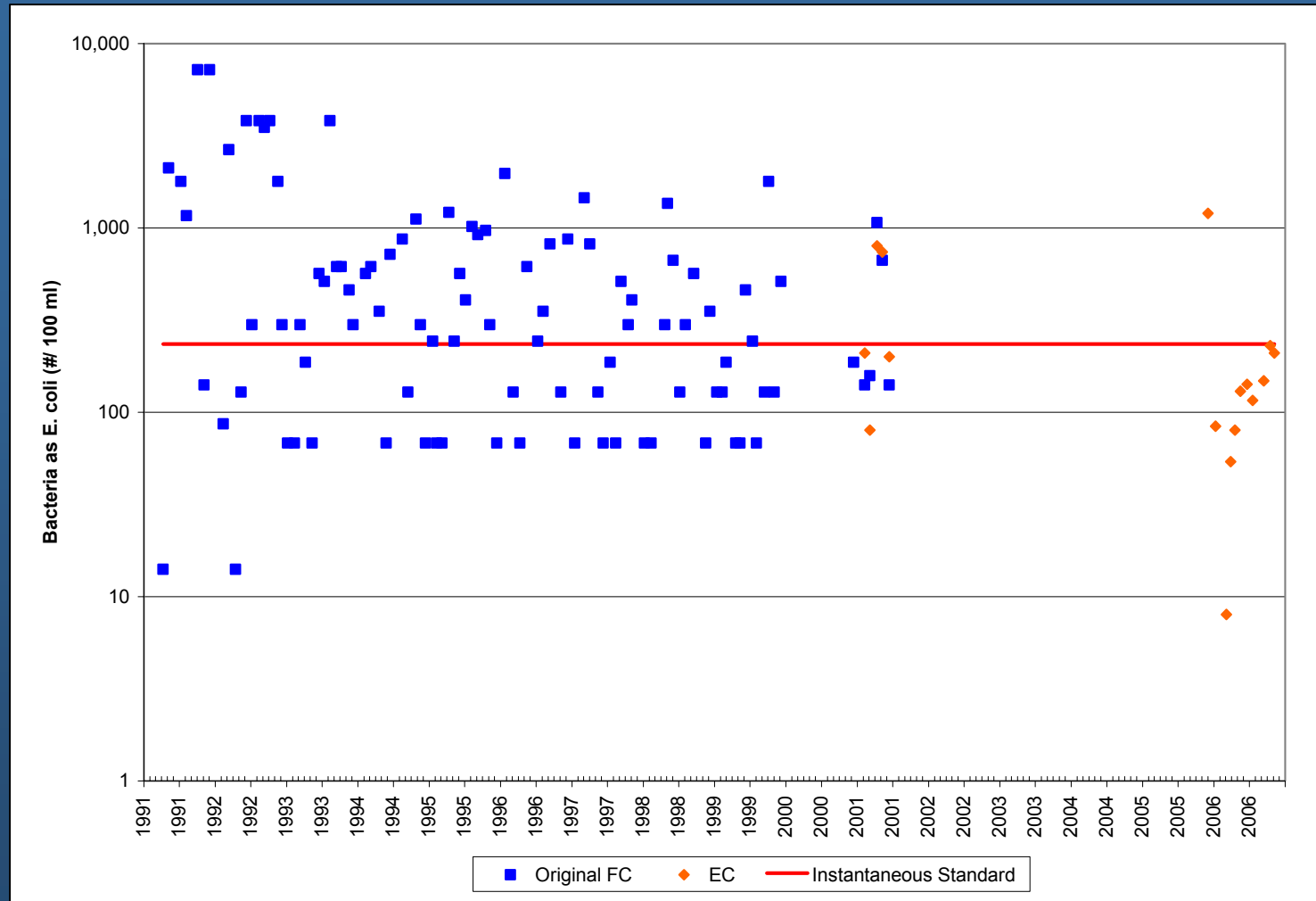
Fecal Coliform Monitoring Data Tidal Four Mile Run



E. Coli Monitoring Data Tidal Four Mile Run

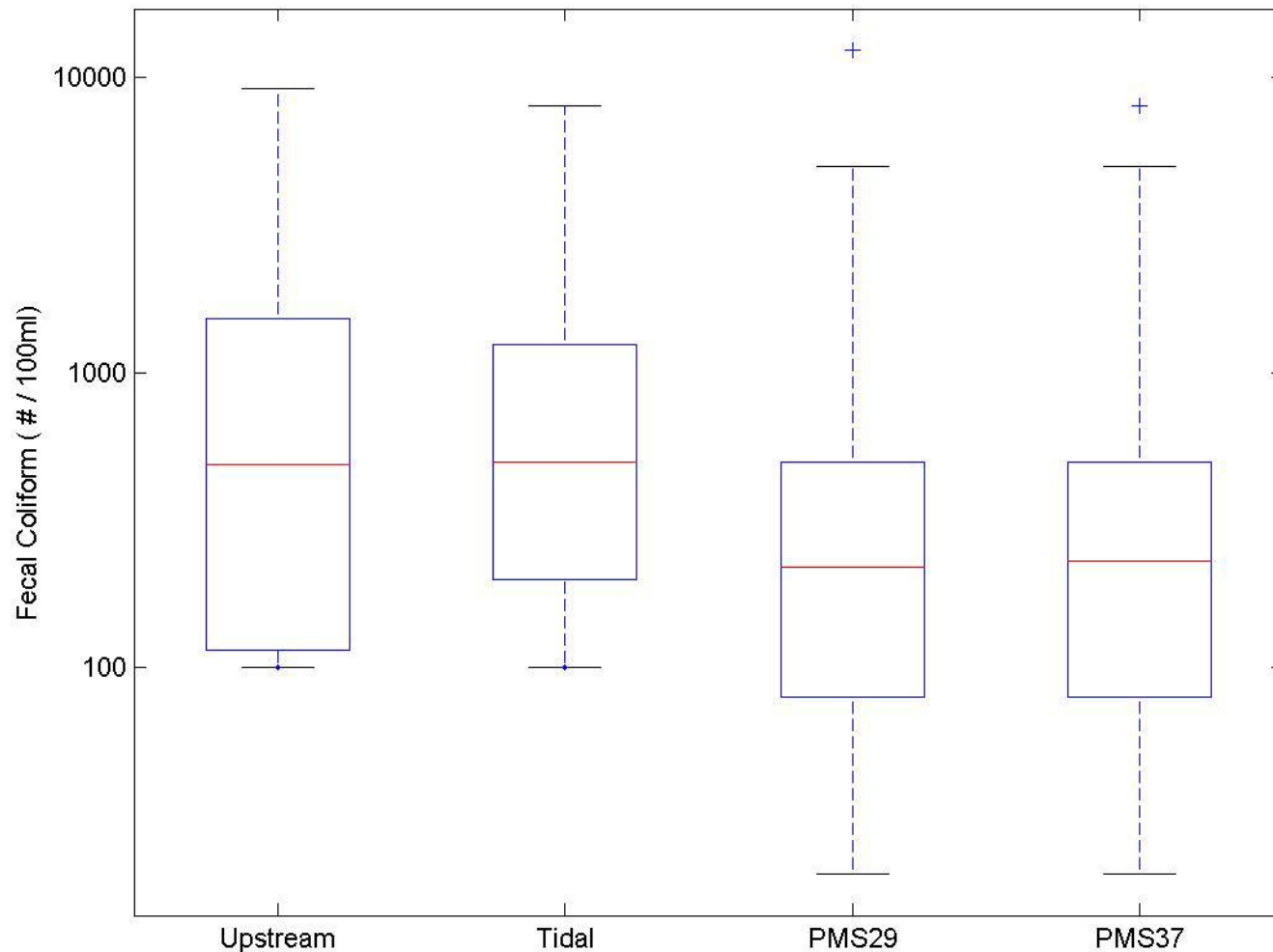


Bacteria Monitoring Data Equivalent *E. Coli* Concentration Tidal Four Mile Run

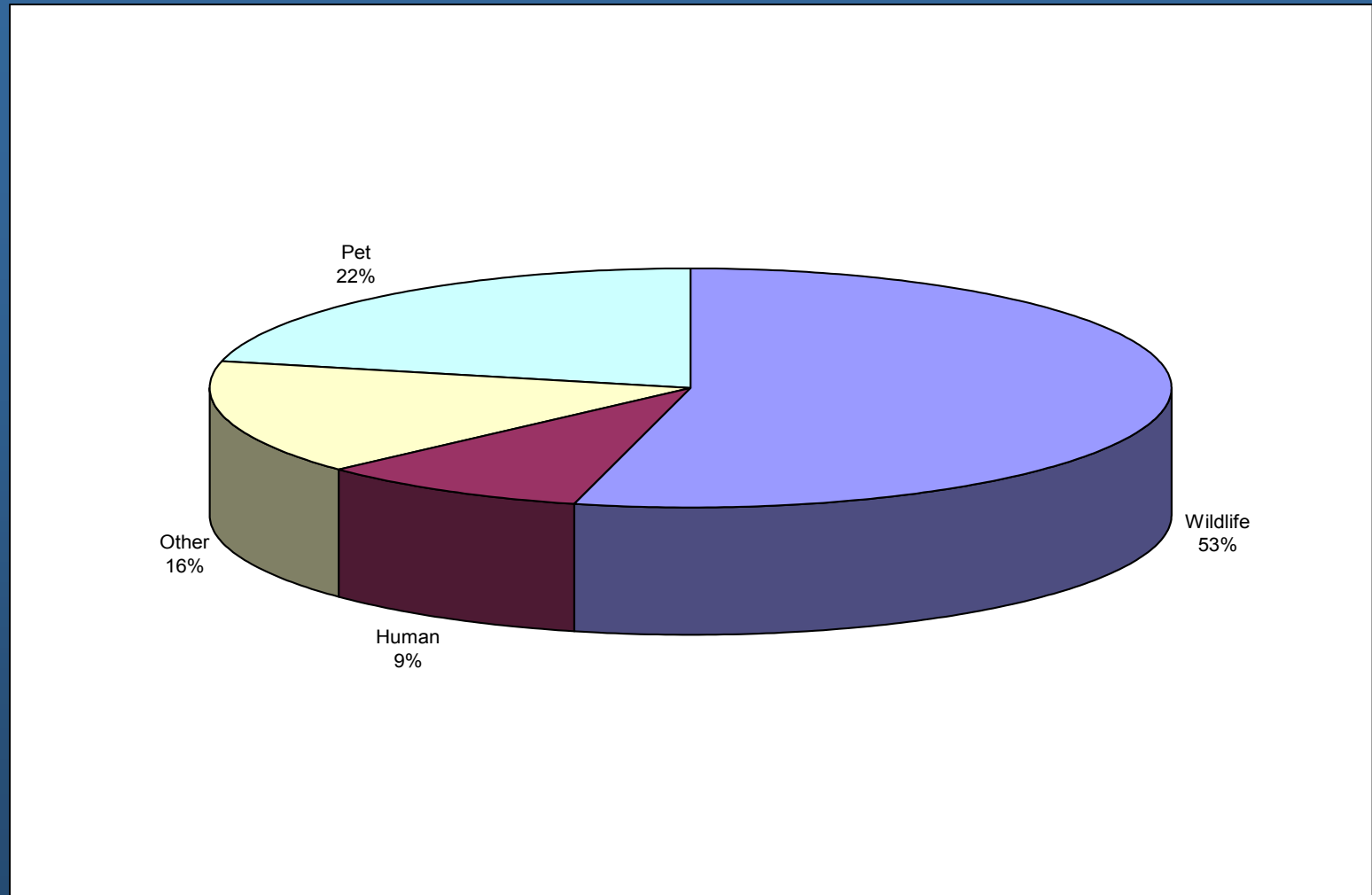


$$\log_2 EC = -0.0172 + 0.91905 \cdot \log_2 FC$$

Comparison of Bacteria Concentrations at Monitoring Stations



Bacteria Source Tracking (BST) Results for Tidal Four Mile Run



Consistent with Non-tidal BST Results

Arlington WWTP

Monthly Averages	Flow (MGD)	Fecal Col. (#/100 ml)	<i>E. Coli</i> (#/100 ml)
Mean	27.6	2.5	11.7
Median	27.5	1.4	7.3
90th Per.	31.6	5.5	23.4
Max	35.3	12.9	96.0
Period	2000-2008	2000-2003	2003-2008

Technical Approach: Consistency with Non-Tidal TMDL

- Use HSPF Model to represent upstream fecal coliform loads for simulation period 1/1999-5/2001.
- Extend non-tidal TMDL HSPF model to tidal drainage using NVRC land use and LU loading rates from non-tidal TMDL.

Technical Approach:

Development of CE-QUAL-W2 Tidal Model

- 2-D Laterally Averaged Continuous Simulation Model.
- Simulates both hydrodynamics and fate and transport of bacteria.
- Used in VA for tidal James River Bacteria TMDL and (many other TMDLs).

CE-QUAL-W2 Inputs

- Bathymetry: Corps of Engineers Flood Control Design
- Meteorology: Reagan National Airport
- Tides: DC Ship Channel
- DC Boundary: DC Potomac Monitoring Data (Baseline Conditions)
- WWTP: Discharge Monitoring Reports
- Upstream and Tidal Drainage Flows and Loads: HSPF Model (Baseline Conditions)

Tentative TMDL Scenario

Assumptions

- DC Boundary Concentration at 126 #/100 ml (DC Geomean Standard)
- Upstream Boundary Concentration at 126 #/100 ml (VA Geomean Standard)
- Arlington WWTP at 126 #/100 ml (permitted concentration) and 40 MGD design flow (+ growth)

TMDL Objective

Determine WLA and LA for tidal drainage that enables tidal Four Mile Run to meet Water Quality Standards for E. Coli bacteria: 126 #/100 ml monthly geometric mean concentration and 235 #/ 100 ml instantaneous concentration.

Tasks

- Preliminary Data Analysis
- Preliminary Hydrodynamic Model
- HSPF Model Extension
- Analysis of WWTP Data, Boundary Conditions
- Preliminary Tidal Bacteria Model
- Tidal Model Calibration and Refinement
- TMDL Scenario Development
- TMDL Documentation

Completed

Questions?

What happens next?

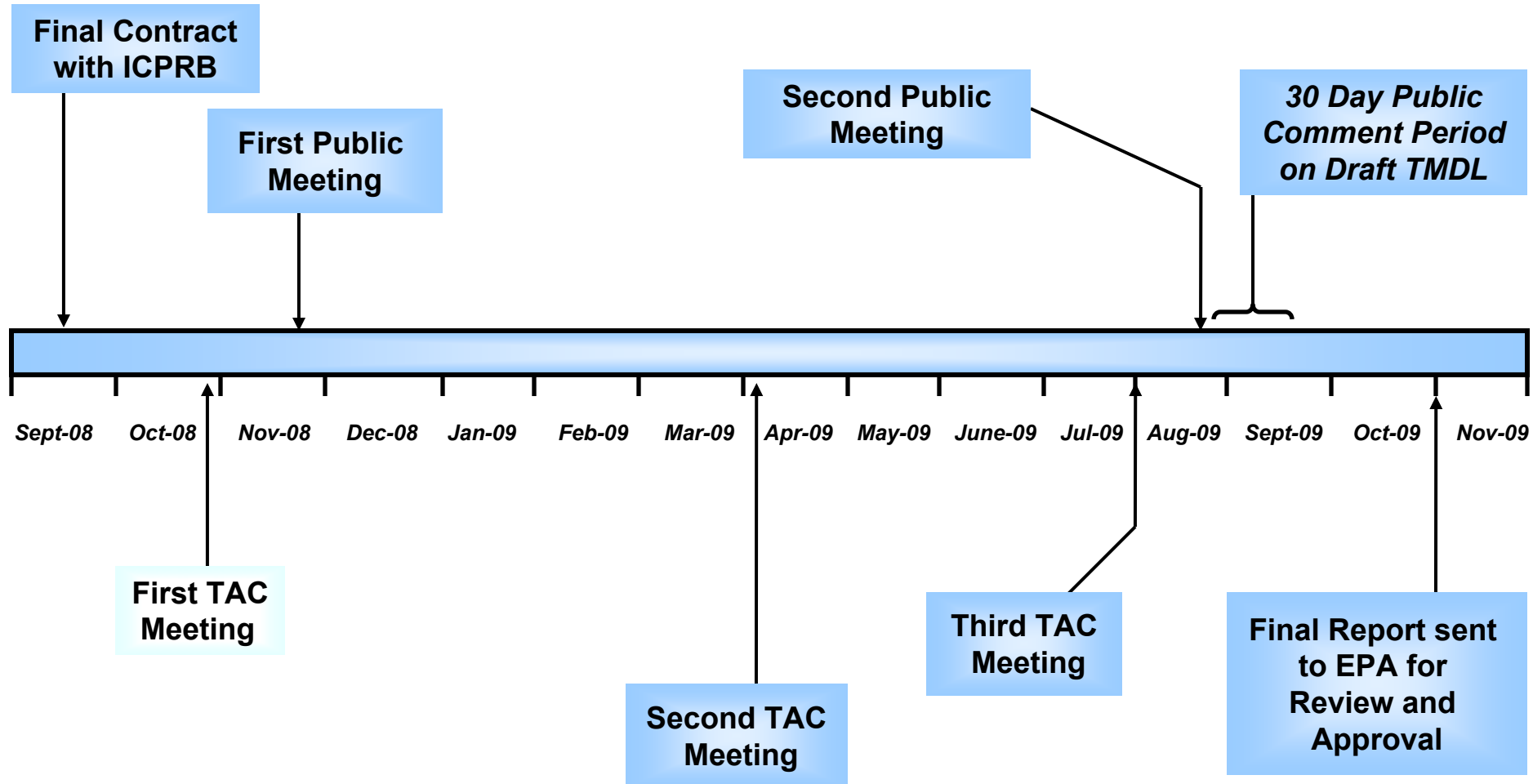
1. Comment Period for Materials Presented at the TAC Meeting:

- October 30, 2008 to November 30, 2008
- Comments should be submitted in writing to:
Katie Conaway
mkconaway@deq.virginia.gov
13901 Crown Court, Woodbridge, VA 22193

2. Public Meeting:

- Wednesday, November 19, 2008 at 7:00 p.m.
Fairlington Community Center
Multi-Purpose Room 134
3308 South Stafford Street, Arlington, VA 22206
- Help to advertise the public meeting by distributing fact sheets and fliers to interested parties.

Tidal Four Mile Run Bacteria TMDL Project Milestones



** Schedule subject to change.*

CONTACTS



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